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ORIGINAL RESEARCH

Evaluation of bone quality at implant site with CBCT- A clinical study

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ABSTRACT:

Background: The insertion of dental implants has become an increasingly common procedure in the oral rehabilitation of partially and totally edentulous patients. The present study was conducted to evaluate bone quality at implant site with CBCT.

Materials & Methods: The present study was conducted on 82 partially edentulous patients of both genders. All underwent CBCT taken with Kodac machine operating at 120 kVp, 12 mA and 17 seconds exposure. Bone quality was labeled as D1, D2, D3, D4 and D5 based on Hounsfield units. **Results:** Out of 82 patients, males were 32 and females were 50. The mean HU at anterior maxilla was 864.2, at anterior mandible was 1280.2 HU, at posterior maxilla was 324.2 HU and at posterior mandible was 732.6 HU. The difference was significant ($P < 0.05$). **Conclusion:** Authors found that anterior mandible had maximum density followed by anterior maxilla, posterior mandible and posterior maxilla. CBCT is useful in assessing bone density at implant site based on Hounsfield units.

Key words: CBCT, Maxilla, Implant.

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INTRODUCTION

The insertion of dental implants has become an increasingly common procedure in the oral rehabilitation of partially and totally edentulous patients. This trend has certainly contributed to the positive results of numerous clinical studies regarding implant survival rates. The success of any implant procedure depends on a series of patient-related and procedure dependent parameters, including general health conditions, biocompatibility of the implant material, the features of the implant surface, the surgical procedure, and the quality and quantity of the local bone.¹ Based on the literature data, the success rate of implants is higher in the lower jaw than the upper jaw. This discrepancy may arise from the bone conditions around the implants. It is evident that, when compared with the maxilla, the bone surrounding the implant has a better volume and quality in the mandible.²

Bone density seems to be of great importance not only in primary implant stability but also in the predictability for oral implant outcomes. The literature describes a large number of classifications and procedures for the determination of jawbone density. The most commonly used classification has been the one proposed by Lekholm and Zarb³, based on the amount of cortical and trabecular bone shown in preoperative panoramic and cephalometric radiographs. T Misch suggested that computed tomography (CT) can be used for the objective quantification of direct density measurements of bone, expressed in Hounsfield units (HU).⁴ HU represent the relative density of body tissues according to a calibrated grey-level scale. They classified bone density as Q1 to Q4 according to the ratio of cortical bone to spongy bone. Cone beam computed tomography useful diagnostic tool especially in implant site assessment. It provides three dimensional information

of the implant site.⁵The present study was conducted to evaluate bone quality at implant site with CBCT.

MATERIALS & METHODS

The present study was conducted in the department of oral medicine and radiology. It comprised of 82 partially edentulous patients of both genders. All patients were informed regarding the study and written consent was obtained. The study was approved from institutional ethical committee.

Data such as name, age, gender etc. was recorded. All underwent CBCT taken with Kodac machine operating at 120 kVp, 12 mA and 17 seconds exposure. All three planes such as sagittal plane, axial and coronal planes were obtained. All images were studied by Oral radiologist. Bone quality was labeled as D1, D2, D3, D4 and D5 based on Hounsefield units. Results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant (P< 0.05).

RESULTS

Table I Distribution of patients

Total- 82		
Gender	Males	Females
Number	32	50

Table I, graph I shows that out of 82 patients, males were 32 and females were 50.

Graph I Distribution of patients

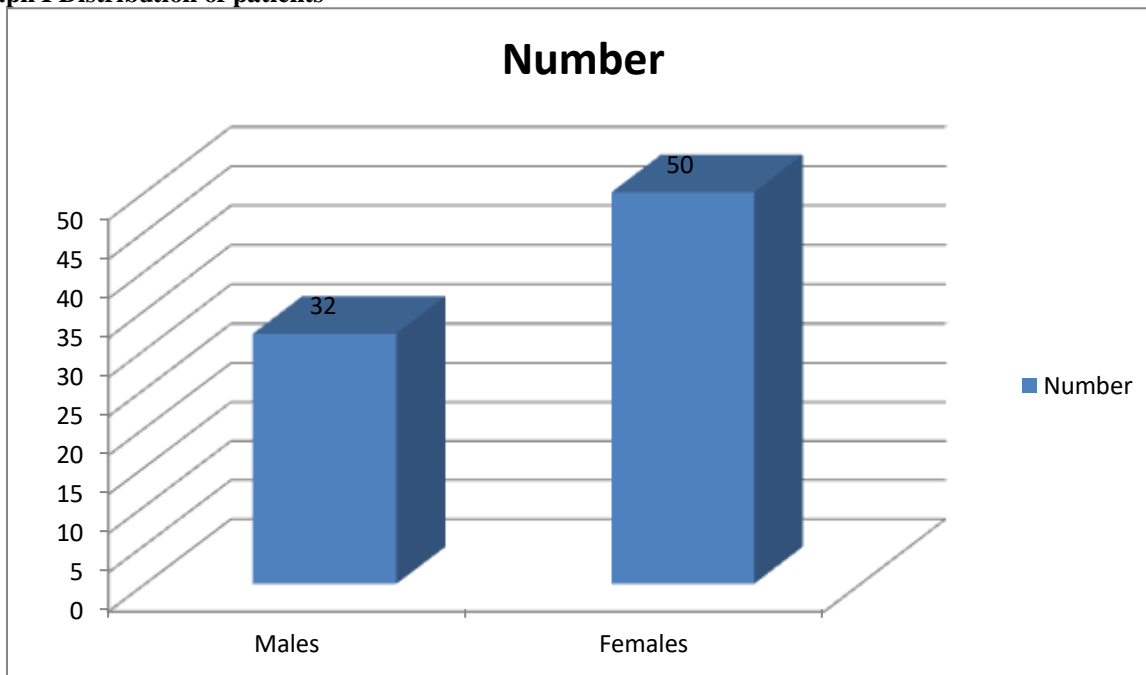
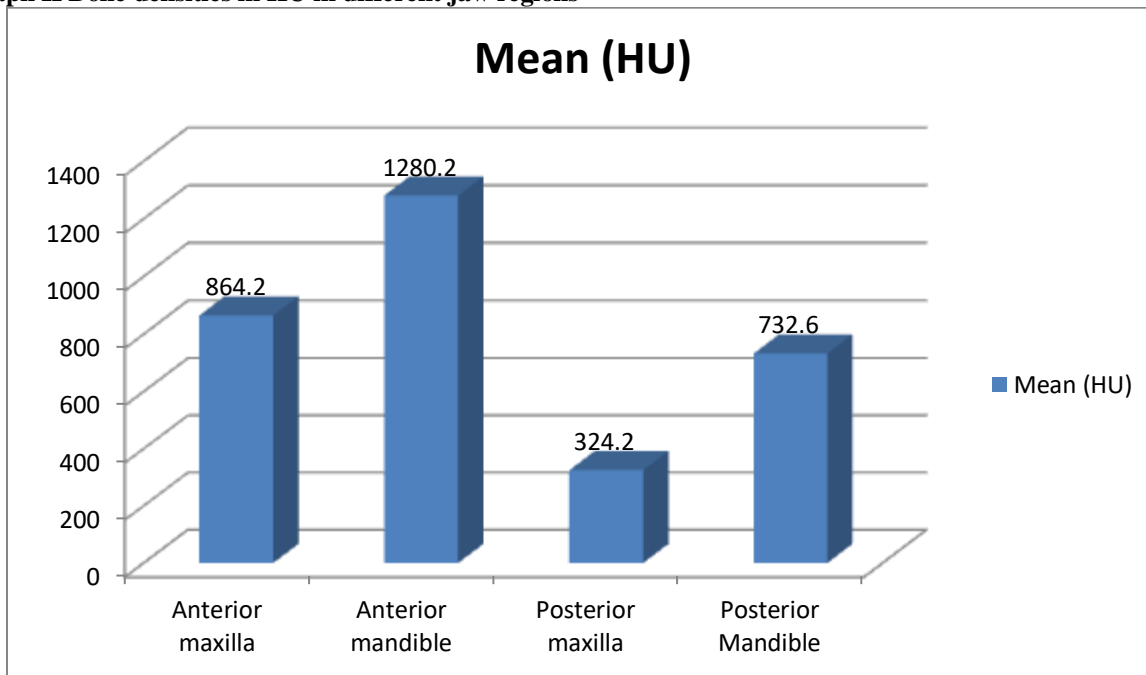


Table II Bone densities in HU in different jaw regions

Region	Mean (HU)	P value
Anterior maxilla	864.2	0.01
Anterior mandible	1280.2	
Posterior maxilla	324.2	
Posterior Mandible	732.6	

Table II, graph II shows that mean HU at anterior maxilla was 864.2, at anterior mandible was 1280.2HU, at posterior maxilla was 324.2 HU and at posterior mandible was 732.6HU. The difference was significant (P< 0.05).

Graph II Bone densities in HU in different jaw regions



DISCUSSION

Dental implants have become a predictable treatment option for restoring missing teeth. The purpose of tooth replacement with implants is to restore adequate function and esthetics without affecting adjacent hard and/or soft tissue structures. The use of dental implants in oral rehabilitation has currently been increasing since clinical studies with dental implant treatment have revealed successful outcomes.⁶ The successful outcome of any implant procedure depends on a series of patient-related and procedure-dependent parameters, including general health conditions, biocompatibility of the implant material, the feature of the implant surface, the surgical procedure, and the quality and quantity of the local bone. Successfully providing dental implants to patients who have lost teeth and frequently the surrounding bone relies on the careful gathering of clinical and radiological information, on interdisciplinary communication and on detailed planning. One of the most important factors in determining implant success is proper treatment planning. In the past, periapical radiographs along with panoramic images were used as the sole determinants of implant diagnosis and treatment planning. With the advancement of radiographic technology, Computed tomography (CT), as well as cone-beam computed tomography (CBCT) is increasingly considered essential for optimal implant placement, especially in the case of complex reconstructions.⁷ The present study was conducted to evaluate bone quality at implant site with CBCT.

In this study, out of 82 patients, males were 32 and females were 50. Turkiyilmaz et al⁸ indicates that the implant location greatly affects the implant success, which is approximately 4% higher in the mandible than in the maxilla, and it is higher in the anterior region than in the posterior region (approximately 12% and 4% in the maxilla and mandible, respectively). This might be explained by the mean bone density being highest in the anterior mandible, followed by the anterior maxilla, posterior mandible, and posterior maxilla.

We found that mean HU at anterior maxilla was 864.2, at anterior mandible was 1280.2 HU, at posterior maxilla was 324.2 HU and at posterior mandible was 732.6 HU. The introduction of new radiographic procedures that allow 3D analysis of the jawbone significantly facilitated the work of therapists and ensures a better treatment outcome. In a CT scan, HU is proportional to the degree of x-ray attenuation, and it is allocated to each pixel to show the image that represents the density of the tissue. This method for pre-operative quantitative and qualitative assessment of dental implant sites is objective and reliable. The dental literature has numerous studies on the usefulness of CT for assessing bone volume and morphology and on the relationship between CT values and primary implant stability. It has been shown that there is a strong correlation between the pre-operative bone density.⁹ CBCT generates cone-shaped beams and the images are acquired in one rotation by an image intensifier of flat panel detector, resulting in reasonably low levels of radiation dosage. During the rotation, multiple (from 150 to more than 600) sequential planar projection

images of the field of view (FOV) are acquired in a complete, or sometimes partial arch. Obvious advantages of such a system, which provides a shorter examination time, include the reduction of image unsharpness caused by the translation of the patient, reduced image distortion due to internal patient movements, and increased x-ray tube efficiency. However, its main disadvantage, especially with larger FOVs, is a limitation in image quality related to noise and contrast resolution because of the detection of large amounts of scattered radiation.¹⁰

CONCLUSION

Authors found that anterior mandible had maximum density followed by anterior maxilla, posterior mandible and posterior maxilla. CBCT is useful in assessing bone density at implant site based on Hounsfield units.

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